

What is claimed is:

1. A system for remote diagnosis of objects positioned in geographically diverse locations, the system comprising:

5 a plurality of data acquisition computers, each of said plurality of data acquisition computers being operatively connected for gathering data from corresponding sensors monitoring a corresponding object;

a diagnostic computer system remotely located from said plurality of data acquisition computers, said diagnostic computer system comprising:

10 a database for storing status data relating to the distributed objects, said status data being gathered by said plurality of data acquisition computers;

an expert system configured for performing signal processing to analyze said status data and identifying disorders of the distributed objects as a function of a correlation between said status data and data stored in said knowledge base; and

15 an alarm system for automatically generating an alarm upon identification of a disorder of one of the distributed objects; and

a server computer located remotely from the objects, said server computer being operatively connected to said diagnostic computer system for communication of data therewith, said server computer storing in its memory a knowledge base for storage of
20 data relating to various types of distributed objects, and information relating to said diagnostic computer system.

2. The system of claim 1, wherein said expert system stores data acquisition rules identifying data acquisition parameters, said expert system being operatively connected to said plurality of data acquisition computers to automatically cause data to be gathered from a monitored object in accordance with corresponding data acquisition parameters identified by a rule applicable to the monitored object.

3. The system of claim 1, wherein said expert system is configured to vary its signal processing according to signal processing results reflecting a current health status of a monitored distributed object, said expert system being configured to automatically vary such signal processing according to predetermined rules stored in the expert system.

4. The system of claim 1, wherein the knowledge base stores object-specific rules regulating data acquisition, signal processing, monitoring and system operation.

5. The system of claim 1, wherein the system for identifying disorders of the distributed objects calculates probabilities of predefined patterns of typical disorders as being a currently observed disorder.

6. The system of claim 1, wherein said knowledge base of said server includes information relating to a type of object, and wherein said diagnostic

computer system stores information relating to a specific object monitored by a corresponding data acquisition computer, wherein detection of a new pattern of failure is communication from said diagnostic computer system to said server for future use in diagnosis of remotely located objects.

5

7. The system of claim 1, wherein the diagnostic computer system relates to a current disorder pattern and a predefined disorder pattern stored in the knowledge base as points in multi-dimensional space.

10 8. The system of claim 7, wherein the diagnostic computer system provides a current disorder classification as a function of a distance between points representing typical disorders and a point representing the current disorder.

15 9. The system of claim 1, wherein the diagnostic computer system creates an online analytical model of probability trends for object disorders.

10. The system of claim 9, wherein the diagnostic computer system forecasts a time when corrective actions should be taken to correct a disorder of the monitored object by future extrapolation of said analytical model.

20

11. The system of claim 10, wherein a threshold for the extrapolation is defined by heuristic rules stored in the knowledge base.

12. The system of claim 1, wherein each monitored object is conceptually
5 decomposed to a relatively small set of basic components.

13. The system of claim 12, wherein the conceptual decomposition relates to a type of distributed objects.

10 14. The system of claim 12, wherein the predetermined disorder patterns relate to the basic components.

15 15. The system of claim 1, wherein the system automatically adds to the knowledge base a new disorder pattern that does not correspond to a predetermined disorder pattern.

16. The system of claim 15, wherein the new disorder pattern is automatically related to all distributed objects of a related type.

20 17. The system of claim 1, wherein the knowledge base comprises:

a rule domains entity including a data acquisition rule domain, a signal processing rule domain, a system customization rule domain, a disorder recognition confidence rule domain, an archiving rule domain, a report generation rule domain, and a data transmission rule domain.

5

18. The system of claim 12, wherein the knowledge base stores threshold values relating to diagnostic parameters for each basic component, and a disorder pattern for each basic component.

10 19. The system of claim 1, wherein information relating to a specific distributed object, and diagnostic indicator disorder thresholds, are obtained automatically during a customization step before initiation of monitoring and diagnosis of the specific distributed object.

15 20. A method for remote diagnosis of distributed objects, the method comprising:
providing a data acquisition system for acquiring data from a first object during its operation, said data acquisition system acquiring data for certain operating parameters for said first object;

20 providing a database of disorder profiles for various objects including said first object, said database of disorder profiles comprising data for the certain operating parameters that is representative of a known disorder condition;

comparing data gathered from said system to the data of said disorder profiles to identify any disorder profile having a respective statistically significant correlation; and

identifying said first object as experiencing the known disorder condition corresponding to the corresponding disorder profile having a most statistically significant correlation.

21. The method of claim 20, further comprising adding to the database as a new disorder profile the data gathered from said data acquisition system for said first object if said data does not have a statistically significant correlation to any of said disorder profiles.

22. The method of claim 21, further comprising providing a second data acquisition system to acquire data from a second object during its operation, said second data acquisition system acquiring data for certain operating parameters for said second object;

whereby said new disorder profile is available for consideration of disorder of said second object.

23. A system for remote diagnosis of objects positioned in geographically diverse locations, the system comprising:

a plurality of data acquisition computers, each of said plurality of data acquisition computers being operatively connected for gathering data from a corresponding sensor monitoring a component of a corresponding object;

5 a server computer located remotely from the objects, said server computer being operatively connected to said plurality of data acquisition computers for communication of data therewith, said server computer storing in its memory a database of disorder profiles for various types of basic components of objects, each of said disorder profiles comprising data for the certain operating parameters that is representative of a known disorder condition;

10 a diagnostic computer system remotely located from said plurality of data acquisition computers, said diagnostic computer system being configured for:

comparing gathered data relating to said component to data of said disorder profiles corresponding to a similar basic component to identify any disorder profile having a respective statistically significant correlation; and

15 identifying said corresponding object as experiencing the known disorder condition corresponding to the disorder profile having the most statistically significant correlation.

20 24. The system of claim 23, wherein said diagnostic computer system is configured to add to the database as a new disorder profile for a respective basic

component the data gathered from said component if said data does not have a statistically significant correlation to any of said disorder profiles.

25. A system for remote diagnosis of objects positioned in geographically diverse
5 locations, the system comprising:

a plurality of data acquisition computers, each of said plurality of data acquisition computers being operatively connected for gathering data from a corresponding sensor monitoring a corresponding monitored object;

a plurality of diagnostic computers, each of said plurality of diagnostic computers
10 being configured to:

compare data gathered from said corresponding monitored object to data of a pre-existing disorder profile for a similar object to identify a respective statistically significant correlation;

identify said corresponding monitored object as experiencing the known
15 disorder condition if there is a statistically significant correlation; and

identify a new disorder condition of the corresponding monitored object that does not have a statistically significant correlation to the known disorder condition; and

a server computer located remotely from the objects, said server computer being operatively connected to said plurality of diagnostic computers for communication of
20 data therewith, said server computer storing in its memory a database of disorder

profiles for various objects, each of said disorder profiles comprising data for the certain operating parameters that is representative of a known disorder condition;

wherein each of said diagnostic computers is configured to add to the server's database as a new disorder profile for a respective object the data gathered from said
5 corresponding monitored object that represents said new disorder condition if said data does not have a statistically significant correlation to any disorder profile of any known disorder condition;

whereby said new disorder profile is retained at said remotely located server and is accessible for diagnosis of disorders of similar objects at locations distinct from said
10 corresponding monitored object.